DOCUMENT RESUME

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ABSTRACT

Instructional objectives and performance requirements are outlined in this course guide for Welding III, an advanced course in arc welding offered at the Community College of Allegheny County to provide students with the proficiency necessary for industrial certification. The course objectives, which are outlined first, specify that students will learn to weld single vee groove weld-butt joints with backing strips in the flat, horizontal, and vertical positions following code specifications established by the American Welding Society (AWS) and the American Society of Mechanical Engineers (ASME). Required texts and lab materials are identified prior to the presentation of a list of course achievement standards for 16 performance areas: setting up test plates; tacking test plates; electrode manipulation; achieving a proper height above the test plate surface; undercutting on a finished weld; bend tests; draglines; guarding gouges while cutting test plates; finishing a test plate cut; bead height/width during oxy-acetylene welding; ripple spacing; and penetration. The guide then presents an outline of the topics, activities, and tests to be covered and/or completed during each of the 16 weeks in the semester. Objectives and instructions follow for each of 16 performance tasks which form the basis of student evaluation. AWS and ASME welder qualifications are appended along with forms to be used in keeping student records. (JP)

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ED194132

COMMUNITY COLLEGE OF ALLEGHENY COUNTY

CENTER-NORTH

WELDING III

72201

3 Credits/2 Lectures/3 Labs

U S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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JC 800 550

COMMUNITY COLLEGE OF ALLEGHENY COUNTY

CENTER-NORTH

WELDING III
72201

3 Credits/2 Lectures/3 Labs

I. DESCRIPTION

An advanced course in shielded metal arc welding procedures in order to develop proficiency within the individual in order to qualify for industrial certification which will consist of: welding single vee groove weld-butt joints with backing strips in the flat, horizontal and vertical positions following the American Welding Society (AWS) and the American Society of Mechanical Engineers (ASME) code specifications. The theory and application of oxy-acetylene welding will be introduced.

Prerequisite: 72102 Welding II or by permission of instructor.

II. OBJECTIVES

A. The student should complete Welding II objectives before moving on to Welding III course objectives.

B. The student should become proficient in three welding positions using the single vee groove weld butt joint, with a backing strip.

C. The student should have the ability to qualify for industrial certification.

III. TEXTBOOKS

A. Welding Skills and Practices; Giachino, Weeks.
B. Oxy-acetylene Welding, Cutting, Brazing; Hobart Brothers.

IV. MATERIALS NEEDED BY STUDENTS

A. Welding Helmet (flip lens)
B. Welding Gloves
C. Protective Clothing
D. Leather Jacket and Sleeves
E. Pliers

V. SUPPLEMENTARY TEXTS

A. Pocket Welding Guide; Hobart Brothers.
B. Complete Welding Library; Location: Media Center (Library).
C. Handouts on Welding, Cutting and Safety. Supplied by instructor.

VI. STANDARDS OF ACHIEVEMENT

A. Competencies

Sixteen (16) performance-welding tasks performed by students and graded visually by the welding instructor. (See duties and tasks)

Criterion for Evaluation of Competencies (checked by the instructor)

AREA OF EVALUATION	WHAT I AM LOOKING FOR
Vee Groove Weld-Butt Joints	
1. Set up of test plates	According to applicable code (under welder qualifications)
2. Tacking of test plates	According to instructor's specifications
3. Electrode manipulation	Should conform to instructor's specifications
4. Height of finished weld above test plate surface	1/16 in. to 1/8 in.
5. Run off tabs	Should be welded to height and width of finished weld
6. Undercut on finished weld (surface of test plate)	Little or none
7. Acceptance criteria guided bend tests	Should conform to applicable code specifications (under welder qualifications)
Machine Oxygen Cutting Test Plates	
1. Draglines	Are near vertical; not too pronounced
2. Gouging on face of cut	Due to slag inclusions or lack of penetration
3. Finished cut	Very little if any visable signs of slag inclusions or lack of penetration; a clean cut should be produced the length of the test plate (refer to draglines above)
Oxy-acetylene Welding	
1. Bead height and width	Changes with joint configurations (instructor's specifications)

AREA OF EVALUATION	WHAT I AM LOOKING FOR
Oxy-acetylene Welding (Continued)	
2. Ripple spacing	Evenly spaced and arc shaped
3. Penetration	Changes with joint configurations (instructor will set specifications)

B. Written test (1) consisting of:

a. Multiple choice
b. True and false
c. Essay
d. Written tests scheduled throughout the semester including the final exam

C. Grading (See Standards of Achievement and Grading)

1. Upon satisfactory completion of all performance tests and written examinations, the student is assigned a letter grade (see appendix).

2. If the student does not satisfactorily complete the performance tests and written examinations, a grade of "I" (Incomplete) is assigned and the student should be encouraged to register again for Welding III the following semester.

NOTICE TO INSTRUCTORS:

These chapters on theory and practical application are to be covered during the course. The format on the Topic Outline is suggested. Changes in the sequence in which it is presented are at the discretion of the instructor to compensate for class size and/or equipment availability.

Explanation of headings under Topic Outline.

WEEK:

The Topic Outline is set up for a 16-week course.

PAT CASSETTE TOPIC:

This is programmed Audio-Visual Training, by Hobart. Projector and cassettes are located in the instructors' cabinet. 16 mm movies are located in the Media Center. You must give five (5) days notice to reserve for showing.

CLASS TOPIC:

Instructor and student objectives

ELECTRODE SIZE/TYPE:

To be used in relation to the class topic.

PERFORMANCE PLATES:

These are welding test plates performed by the student and graded visually by the instructor. (Pictures of finished plates included)

CHAPTER ASSIGNMENT:

The assignments should be given to the student a week in advance for study.

TEXT:

Welding Skills & Practices

WELDING III

72201

TOPIC OUTLINE

Week	Class Topic	Electrode Size/Type	Performance Objectives	Chapter Assignment
1	Introduction, Course Outline Objectives — Safety			
2	Set up - tack vee groove w/ backing (ASME)	7018	1	
	Vee groove w/ backing 1G position (ASME)	7018	2	
3	Vee groove w/ backing 1G position (ASME)	7018		
	Machine oxygen cut test plates		3	
4-5-6	Vee groove w/ backing 3G position (ASME)	7018	4	
	Machine cut test plates or Guide Bend Test			
7-8	Set up - tack vee groove w/ backing 1G (AWS)	7018	5	
	Vee groove w/ backing (AWS)	7018	6	
	Machine oxygen cut test plates			
9-10	Vee groove w/ backing 3G position (AWS)	7018	7	
11	Guided Bend Test - prepare and bend		8	
12-13	Set up - tack vee groove w/ backing (AWS) 2G	7018	9	
	Vee groove w/ backing or single bevel w/ backing (AWS) 2G position	7018	10	21 22 23
14	Set up oxy-acetylene equipment		11	23
	Puddling on mild steel		12	
	Running beads w/ filler rod		13	

Week	Class Topic	Electrode Size/Type	Performance Objectives	Chapter Assignment
15	Butt weld 1/8" m.s.		14	23
	Gas weld corner joints		15	
	Gas weld lap joints		16	
16	Written test (Final)			

DUTIES & TASKS

DUTIES & TASKS

A supply of the Competency Based Duties & Tasks are available in each welding laboratory.

The instructor should issue the duties and tasks to the student as he progresses through the course so that the student knows exactly what he is to do and how his performance will be evaluated.

WELDING III

DUTY: Set Up, Tack and Weld Metal Processing Projects

TASK: Set Up and Tack Weld Single Vee Groove Weld-Butt Joints With Backing (ASME) 1G

1. Performance Objective

Given two 3/8" x 3" x 6" plates, backing strip and welding equipment, set up, align and tack weld single vee groove weld-butt joints with backing. Dimensions must meet specifications of American Society of Mechanical Engineers (ASME), Section IX, Pg. 4-6-13,. QW-469.1

Criterion-Referenced Measure

Set up two 3/8" x 3" x 6" plates with backing, align and tack weld single vee groove weld-butt joints.

Performance Guide

1. Select safety and welding equipment
2. Clean plates and backing strip
3. Align plates on flat surface
4. Space plates to proper root opening with backing according to ASME specifications
5. Use E-7018 electrodes with diameters as per instructor's specifications
6. Tack plates as per instructor's specifications

WELDING III

DUTY: Set Up, Tack and Weld Metal Processing Projects

TASK: Set Up, Tack and Weld Single Vee Groove Weld-Butt Joints With Backing In The 1G Position (ASME)

2. Performance Objective

Given two 3/8" x 3" x 6" plates, backing strip and welding equipment, set up, align and tack weld plates to backing according to ASME specifications, Section IX, Pg. 4-6-13, QW-469.1.

Position test plates in the 1G position and weld as per instructor's specifications.

Criterion-Referenced Measure

Set up two 3/8" x 3" x 6" plates with backing strip, tack and weld to specifications.

Performance Guide

1. Select safety and welding equipment
2. Clean plates and backing strip
3. Space plates to proper root opening with backing as per ASME specifications
4. Use E-7018 electrodes with diameters as per instructor's specifications
5. Tack plates as per instructor's specifications
6. Weld plates in 1G position according to instructions

DUTY: Operating Auxiliary Equipment

TASK: Cut Test Plates With Machine Oxygen Cutting Equipment

3. Performance Objective

Given test plates welded in the 1G position and machine oxygen cutting equipment, set up and cut test plates on the centerline of the finished weld parallel with the length of the weld (6"). This cut is made through the center of the weld and backing strip to section the welding test. Visual inspection will show: (1) Draglines are essentially vertical and not too pronounced; (2) No gouging along the face of the cut. (Gouging is caused by slag inclusions or lack of penetration which deflect the preheat and high pressure oxygen stream to one side of the kerf, and this shows up as a welding defect.)

Criterion-Referenced Measure

Set up machine oxygen cutting equipment and cut test plates.

Performance Guide

1. Select proper safety and cutting equipment
2. Set up machine oxygen cutting equipment
3. Cut off run-off tabs from each end of test plate
4. Scribe center of weld with soapstone
5. Set test plate under torch to start cut from face of weld
6. Make cut the length of the weld

WELDING III

DUTY: Set Up, Tack and Weld Metal Processing Projects

TASK: Set Up, Tack and Weld Single Vee Groove Weld-Butt Joints With Backing In The 3G Position (ASME)

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4. Performance Objective

Given two 3/8" x 3" x 6" plates, backing strip and welding equipment, set up, align and tack weld plates to backing according to American Society of Mechanical Engineers specifications, Section IX, Pg. 4-6-13, QW-469.1. Position test plates in the 3G position and weld as per instructor's specifications.

Criterion-Referenced Measure

Set up two 3/8" x 3" x 6" plates with backing strip, tack and weld to specifications.

Performance Guide

1. Select safety and welding equipment
2. Clean plates and backing strip
3. Space plates to proper root opening with backing as per ASME specifications
4. Use E-7018 electrodes with diameters as per instructor's specifications
5. Tack plates as per instructor's specifications
6. Weld plates in 3G position according to instructions

WELDING III

DUTY: Set Up, Tack and Weld Metal Processing Projects

TASK: Set Up and Tack Weld Single Vee Groove Weld-Butt Joints With Backing 1G (AWS)

5. Performance Objective

Given two 3/8" x 3" x 6" plates, backing strip and welding equipment, set up, align and tack weld single vee groove weld-butt joints with backing. Dimensions must meet specifications of American Welding Society D1.1-75, for Limited Thickness Fig. 5.19a, Pg. 60.

Criterion-Referenced Measure

Set up two 3/8" x 3" x 6" plates with backing, align and tack weld single vee groove weld-butt joints.

Performance Guide

1. Select safety and welding equipment
2. Clean plates and backing strip
3. Align plates on flat surface
4. Space plates to proper root opening with backing according to AWS specifications
5. Use E-7018 electrodes with diameters as per instructor's specifications
6. Tack plates as per instructor's specifications

WELDING III

DUTY: Set Up, Tack and Weld Metal Processing Projects

TASK: Set Up, Tack and Weld Single Vee Groove Weld-Butt Joints With Backing In The 1G Position (AWS)

6. Performance Objective

Given two 3/8" x 3" x 6" plates, backing strip and welding equipment, set up, align and tack weld plates to backing according to AWS specifications. Position test plates in the 1G position and weld as per instructor's specifications.

Criterion-Referenced Measure

Set up two 3/8" x 3" x 6" plates with backing strip, tack and weld to specifications.

Performance Guide

1. Select safety and welding equipment
2. Clean plates and backing strip
3. Space plates to proper root opening with backing as per AWS specifications
4. Use E-7018 electrodes with diameters as per instructor's specifications
5. Tack plates as per instructor's specifications
6. Weld plates in 1G position according to instructions

WELDING III

DUTY: Set Up, Tack and Weld Metal Processing Projects

TASK: Set Up, Tack and Weld Single Vee Groove Weld-Butt Joints With Backing In The 3G Position (AWS)

7. Performance Objective

Given two 3/8" x 3" x 6" plates, backing strip and welding equipment, set up, align and tack weld plates to backing according to American Welding Society specifications D1.1-75, Fig. 5.19a, Pg. 60. Position test plates in the 3G position and weld as per instructor's specifications.

Criterion-Referenced Measure

Set up two 3/8" x 3" x 6" plates with backing strip, tack and weld to specifications.

Performance Guide

1. Select safety and welding equipment
2. Clean plates and backing strip
3. Space plates to proper root opening with backing as per AWS specifications
4. Use E-7018 electrodes with diameters as per instructor's specifications
5. Tack plates as per instructor's specifications
6. Weld plates in 3G position according to instructions

DUTY: Clean, Test and Classify Metals

TASK: Test Metals Using Guided Bend Tester

8. Performance Objective

Given test plate requiring a guided bend test and necessary equipment, remove and prepare specimens from test plate according to applicable code. Place samples in bend tester and perform test according to code instructions or requirements of the American Welding Society Code D1.1-75, Pg. 45 and American Society of Mechanical Engineers, Section IX, QW 160, Pg. 1-3 (2, 3).

Criterion-Referenced Measure

Test specimens using guided bend tester.

Performance Guide

1. Select safety equipment
2. Select necessary tools and equipment
3. Select test plate
4. Select cutting method
5. Cut specimens
6. Machine grind specimens as required
7. Place specimens in machine and bend as required
8. Record results of tests

WELDING III

DUTY: Set Up, Tack and Weld Metal Processing Projects

TASK: Set Up and Tack Weld Single Vee Groove Weld-Butt Joints With Backing (AWS) 2G

9. Performance Objective

Given two 3/8" x 3" x 6" plates, backing strip and welding equipment, set up, align and tack weld single vee groove weld-butt joints with backing. Dimensions must meet specifications of American Welding Society D1.1-75 for Limited Thickness, Fig. 5.19a, Pg. 60, or an optional test plate Fig. 5.19b.

Criterion-Referenced Measure

Set up two 3/8" x 3" x 6" plates with backing, align and tack weld single vee groove weld-butt joints.

Performance Guide

1. Select safety and welding equipment
2. Clean plates and backing strip
3. Align plates on flat surface
4. Space plates to proper root opening with backing according to AWS specifications
5. Use E-7018 electrodes with diameters as per instructor's specifications
6. Tack plates as per instructor's specifications

WELDING III

DUTY: Set Up, Tack and Weld Metal Processing Projects

TASK: Set Up, Tack and Weld Single Vee Groove Weld-Butt Joints With Backing In The 2G Position (AWS)

10. Performance Objective

Given two 3/8" x 8" x 6" plates, backing strip and welding equipment, set up, align and tack weld plates to backing according to AWS specifications, D1.1-75 for Limited Thickness Fig. 5.19a, Pg. 60 or optional test plate Fig. 5.19b. Position test plates in the 2G position and weld as per instructor's specifications.

Criterion-Referenced Measure

Set up two 3/8" x 3" x 6" plates with backing strip, tack and weld to specifications

Performance Guide

1. Select safety and welding equipment
2. Clean plates and backing strip
3. Space plates to proper root opening with backing as per AWS specifications
4. Use E-7018 electrodes with diameters as per instructor's specifications
5. Tack plates as per instructor's specifications
6. Weld plates in 2G position according to instructions

WELDING III

DUTY: Operating Gas Welding Equipment

TASK: Set Up Portable or Stationary Oxy-Fuel Equipment

11. Performance Objectives

Given oxy-acetylene torch, regulators, hoses, check valves, cylinder wrench, oxygen and fuel cylinders and portable car; set up a portable or stationary outfit. The oxy-fuel equipment will not leak and will operate safely as the manufacturer intended.

Criterion-Referenced Measure

Set up a portable or stationary oxy-fuel outfit.

Performance Guide

1. Chain cylinder to the cart
2. Remove cylinder caps
3. Crack cylinder valves to clean out foreign particles and inspect threads
4. Attach regulators
5. Install check valves
6. Attach hoses
7. Attach hoses to torch
8. Check for leaks

NOTE: ALL VOLATILE GASES SHOULD BE HANDLED WITH EXTREME CARE

WELDING III

DUTY: Operating Gas Welding Equipment

TASK: Puddling on Mild Steel

12. Performance Objective

Given 1/8" thick mild steel, oxy-acetylene welding equipment and tools, draw equally spaced lines on the mild steel sheet with soapstone. Using the puddling technique (without filler wire), make welds along each line on the sheet. Visual inspection of the welds will show: (a) weld beads 1/4" wide; (b) even arc-shaped ripples; (no burn thru).

Criterion-Referenced Measure

Puddling on mild steel sheets

Performance Guide

1. Select safety equipment
2. Clean and prepare mild steel sheets
3. Select proper size tip
4. Set up oxy-acetylene welding equipment
5. Make welds
6. Clean and check welds

WELDING III

DUTY: Operating Gas Welding Equipment

TASK: Running Beads With Filler Rod

13. Performance Objective

Given 1/8" thick mild steel, oxy-acetylene welding equipment and tools; draw equally spaced lines on the mild steel sheet with soapstone. With the torch motion used in puddling, make welds along each line using filler rod. Visual inspection will show: (a) beads 1/4" to 5/16" in width; (b) evenly spaced ripples; (c) bead height 1/16" to 1/8"; (d) crater filled to bead height at welds end; (e) no burn thru; (f) penetration should be 25% of metal thickness.

Criterion-Referenced Measure

Making weld beads on mild steel with filler wire

Performance Guide

1. Select safety equipment
2. Clean and prepare mild steel sheets
3. Select proper tip size according to specifications of manufacturer's equipment used in shop
4. Select proper filler rod (3/32" diameter)
5. Set up oxy-acetylene welding equipment
6. Make welds, then clean and check welds

DUTY: Operating Gas Welding Equipment

TASK: Butt Welding 1/8" Mild Steel Sheets

14. Performance Objective

Given two pieces of 1/8" mild steel sheet, welding equipment and tools, set up mild steel pieces for a butt weld and tack together, perform a butt weld on one side only. Visual inspection will show: (a) bead slightly wider than 1/4"; (b) evenly spaced ripples; (c) 1/16" build-up above surface; (d) 100% penetration; (e) no burn thru; (f) crater filled to bead height.

Criterion-Referenced Measure

Make butt welds on 1/8" mild steel with complete penetration.

Performance Guide

1. Select safety equipment
2. Clean and prepare mild steel sheets
3. Set up oxy-acetylene welding equipment
4. Select proper size filler rod 1/16" or 3/32" diameter
5. Tack sheets together (each end)
6. Make butt weld

WELDING III

DUTY: Operating Gas Welding Equipment

TASK: Gas Weld Corner Joints

15. Performance Objective

Given two pieces of 1/8" mild steel sheet and oxy-acetylene welding equipment; set up mild steel pieces for an outside corner weld. Fit pieces together at a 90° angle with the joint in the open position. Without filler rod perform an outside corner weld. Visual inspection will show: (a) a good surface ripple; (b) even penetration; (c) penetration should show slightly all along the inner vee of the joint; (d) bead was formed by using equal amounts of metal from each plate into the molton puddle.

Criterion-Referenced Measure

Make an outside corner weld without filler rod.

Performance Guide

1. Select safety equipment
2. Clean and prepare mild steel sheets
3. Set up oxy-acetylene welding equipment
4. Use a neutral flame
5. Tack plates at each end in the open position
6. Make weld without filler rod
7. Place weldment on table and flatten with hammer
8. Check for incomplete fusion and cracks

DUTY: Operating Gas Welding Equipment

TASK: Gas Welding Lap Joints

16. Performance Objective

Given two pieces of 1/8" mild steel sheets and oxy-acetylene welding equipment; set up mild steel pieces for a lap weld and tack each end. Perform a lap weld in the horizontal position welding side opposite the tacks first. Visual inspection will show: (a) mild steel pieces overlapping each other 1/4 their width; (b) top edge not melted back too far; (c) bead on top plate straight and uniform; (d) weld face should be convex; (e) even ripples.

Criterion-Referenced Measure

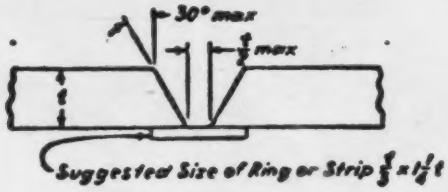
Make a lap weld on 1/8" mild steel using filler rod.

Performance Guide

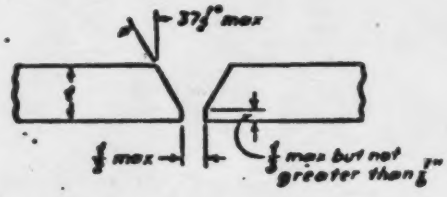
1. Select safety equipment
2. Clean and prepare mild steel sheets
3. Set up oxy-acetylene welding equipment
4. Use 1/16" or 3/32" diameter filler rod
5. Tack pieces together and weld
6. Put piece in vise and bend against weld to inspect the quality of the weld

QW-469 Typical Test Joints

Joints used in all four welding positions when welding with backing strip, or without backing strip.



QW-469.1 BUTT JOINT



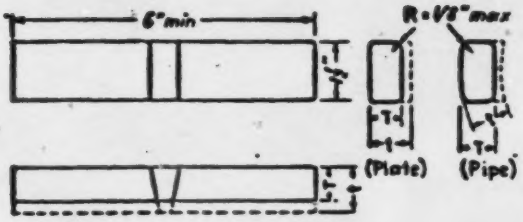
QW-469.2 ALTERNATIVE BUTT JOINT

QW-463 Order of Removal

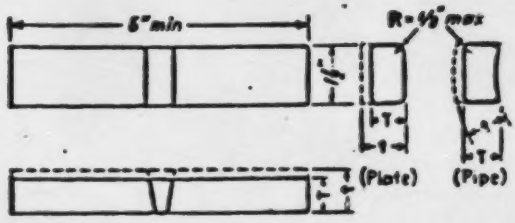
Discard		This Piece
Reduced Section		Tensile Specimen
Root Bend		Specimen
Face Bend		Specimen
Root Bend		Specimen
Face Bend		Specimen
Reduced Section		Tensile Specimen
Discard		This Piece

QW-463.1(a) PLATES–1/16 TO 3/4 IN. PROCEDURE QUALIFICATION

QW-462.3(a) Face and Root Bends – Transverse



Face Bend Specimens - Plate and Pipe



Root Bend Specimens - Plate and Pipe

t, in.	T, in.	
	Metals in QW-422.35 and QW-453	All Other Metals
1/16-1/8	t	t
1/8-3/8	1/8	t
>3/8	1/8	3/8

Note 1: Weld reinforcement and backing strip or backing ring, if any, shall be removed flush with the surface of the specimen. If a recessed ring is used, this surface of the specimen may be machined to a depth not exceeding the depth of the recess to remove the ring, except that in such cases the thickness of the finished specimen shall be that specified above. Do not flame-cut nonferrous material.

Note 2: If the pipe being tested is 3 inch outside diameter or less, the width of the bend specimen may be 3/4 inch, measured around the outside surface. Alternatively, if the pipe being tested is less than 2 inch pipe size (2.375 in. outside diameter), the width of the bend specimens may be that obtained by cutting the pipe into quarter sections, less an allowance for saw cuts or machine cutting.

QW-162 Guided-Bend Test Procedure

QW-162.1 Jigs. Guided-bend specimens shall be bent in test jigs that are in substantial accordance with QW-466. When using the jigs illustrated in QW-466.1 or QW-466.2, the side of the specimen turned toward the gap of the jig shall be the face for face-bend specimens, the root for root-bend specimens, and the side with the greater defects, if any, for side-bend specimens. The specimen shall be forced into the die by applying load on the plunger until the curvature of the specimen is such that a 1/8 in. diameter wire cannot be inserted between the specimen and the die of QW-466.1 or the specimen is bottom ejected, if the roller type of jig, QW-466.2 is used.

When using the wrap around jig, QW-466.3, the side of the specimen turned toward the roller shall be the face for the face-bend specimens, the root for the root-bend specimens, and the side with the greater defects, if any, for side-bend specimens.

When specimens wider than 1-1/2 in. are to be bent as permitted in QW-462.2(a) the test jig mandrel must be at least 1/4 in. wider than the specimen width.

QW-163 Acceptance Criteria - Bend Tests

The weld and heat affected zone of a transverse-weld bend specimen shall be completely within the bent portion of the specimen after testing.

The guided-bend specimens shall have no open defects exceeding 1/8 in., (1/16 in. for corrosion resistance weld overlay cladding), measured in any direction on the convex surface of the specimen after bending, except that cracks occurring on the corners of the specimen during testing shall not be considered unless there is definite evidence that they result from slag inclusions or other internal defects.

QW-303 Limits of Qualified Positions

QW-303.1 Groove Welds - General. Qualification in the 2G, or 3G, or 4G position shall also qualify for the 1G position. Qualification in both the 5G position shall qualify for the 1G, 3G, and 4G positions. Qualification in the 2G and 5G positions, or in the 6G position, shall qualify for all positions.

AWS WELDER QUALIFICATIONS

D1.1-75 Typical Test Joints

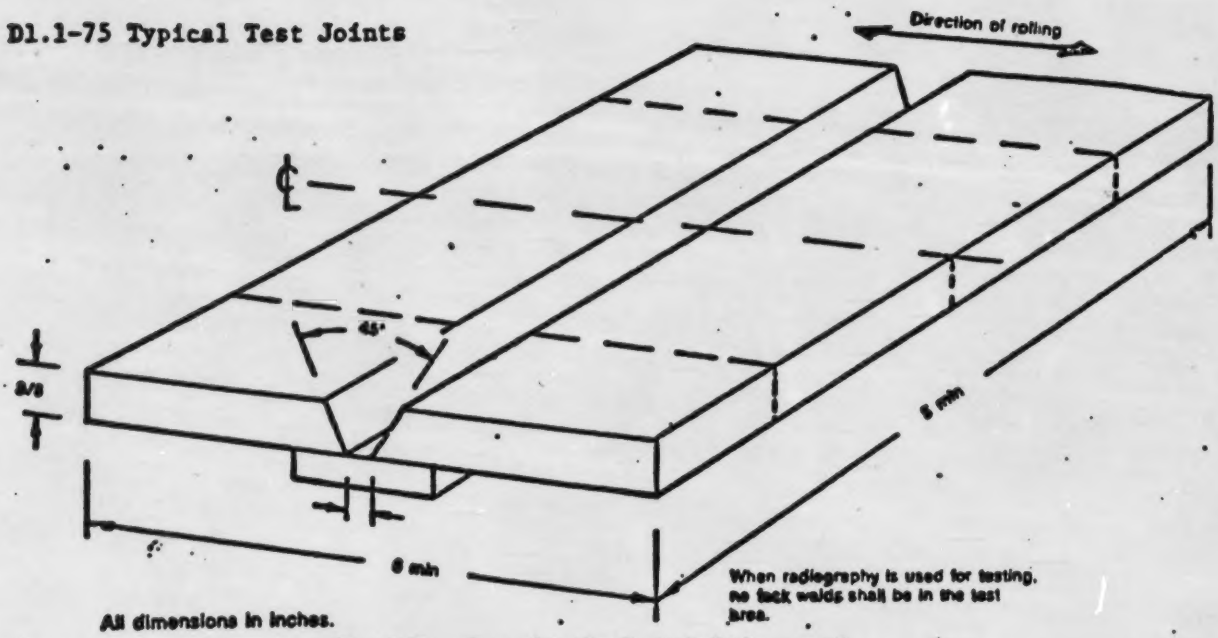

Direction of rolling
45°
3/8
6 min
6 min
When radiography is used for testing, no tack welds shall be in the test area.
All dimensions in inches.

Fig. 5.19a—Test plate for limited thickness—all positions—welder qualification.

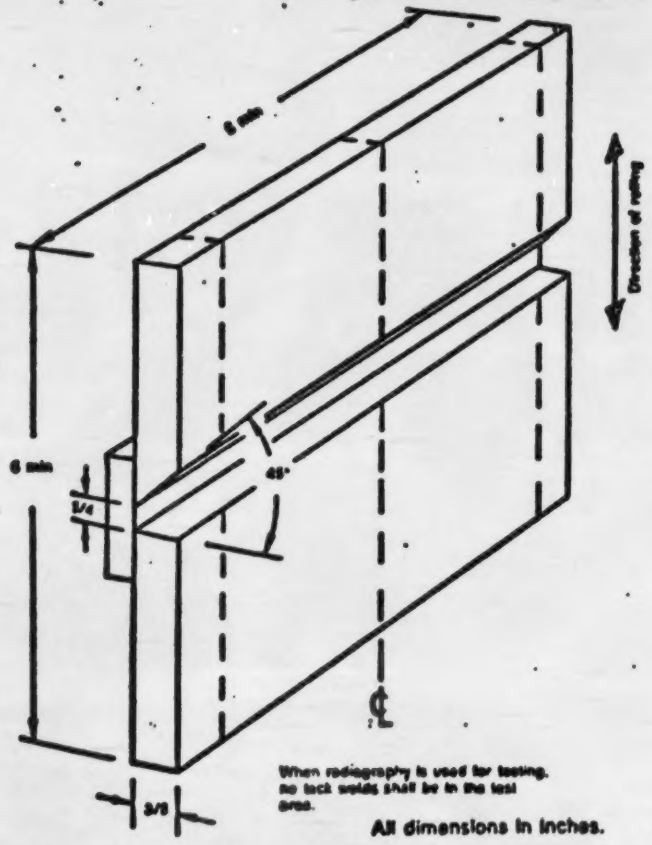


Fig. 5.19b—Optional test plate for limited thickness—horizontal position—welder qualification.

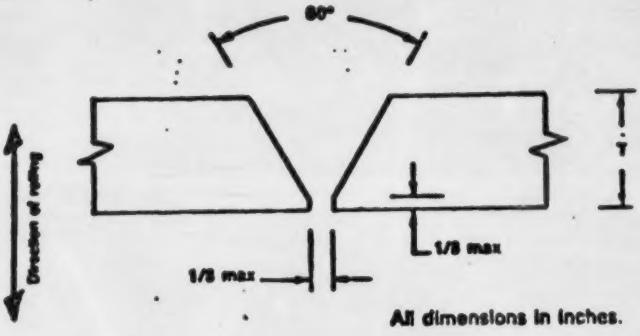


Fig. 5.20a—Plate and pipe butt joint—welder qualification—without backing.

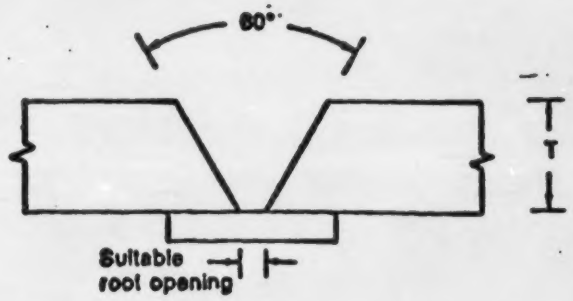
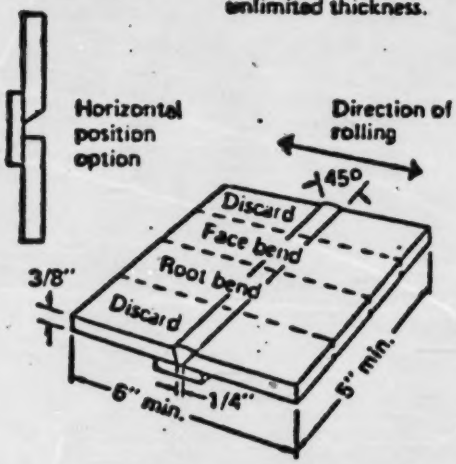


Fig. 5.20b—Pipe test butt joint—welder qualification—with backing.

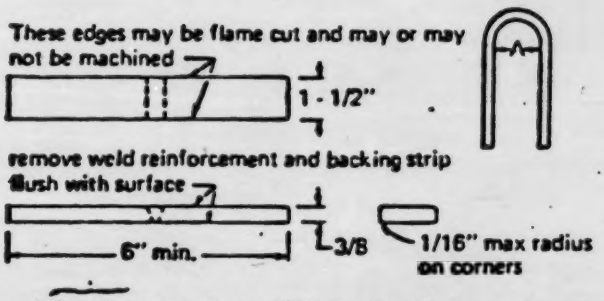
D1.1-75 Order of Removal

AWS Welder Qualification Tests.

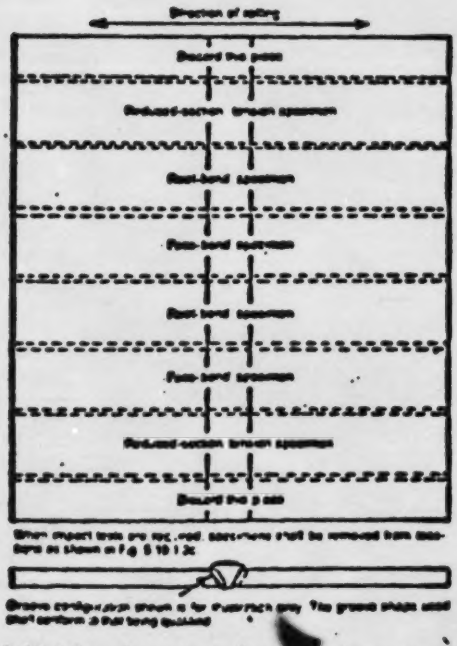
Limited thickness will qualify for groove welds in material not over 3/4" thickness and fillet welds on material of unlimited thickness.



Backing bar is at least 3/8" x 1". If radiography is used then use at least a 3/8" x 3" backing bar.


These edges may be flame cut and may or may not be machined
1 - 1/2"
remove weld reinforcement and backing strip flush with surface
6" min.
3/8
1/16" max radius on corners

Bend specimen passes if any crack or open defect does not exceed 1/8" after bending through an angle of 180°. Cracks at corners are not considered.
Radiographic inspection of test plate may be used instead of guided band test. (A20B)



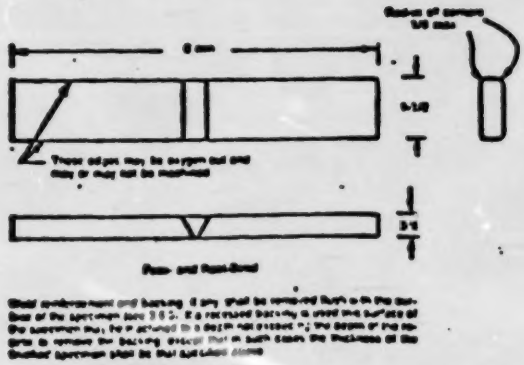


Fig. 5.10.1.3c—Location of test specimens on welded test plate 3/8 in. thick—procedure qualification.

D1.1-75, 5.19 Plate of Limited Thickness

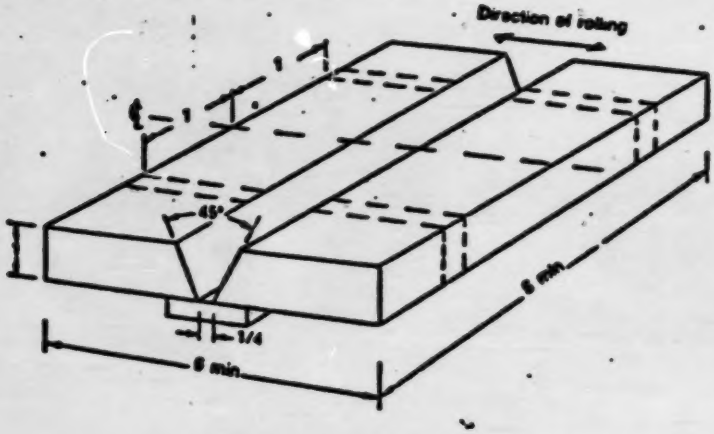


Fig. 5.18a—Test plate for unlimited thickness—welder qualification.

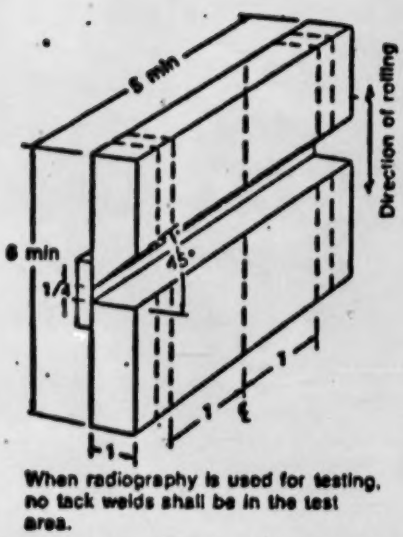


Fig. 5.18b—Optional test plate for unlimited thickness—horizontal position—welder qualification.

5.18 Groove Weld Plate Qualification Test for Plate of Unlimited Thickness

The joint detail shall be as follows: 1 in. (25.4 mm) plate, single-V-groove, 45 deg included angle, 1/4 in. (6.4 mm) root opening with backing (see Fig. 5.18a). For horizontal position qualification, the joint detail may, at the contractor's option, be as follows: single-bevel-groove, 45 deg groove angle, 1/4 in. root opening with backing (see Fig. 5. 18b). Backing must be at least 3/8 in. (9.5 mm) by 3 in. (76.2 mm) if radiographic testing is used without removal of backing. It must be at least 3/8 in. by 2 in. (50.8 mm) for mechanical testing or for radiographic testing after the backing is removed. Minimum length of welding groove shall be 5 in. (127 mm).

5.19 Groove Weld Plate Qualification Test for Plate of Limited Thickness

The joint detail shall be as follows: 3/8 in (9.5 mm) plate, single-V-groove, 45 deg included angle, 1/4 in. (6.4 mm) root opening with backing (see Fig. 5. 19a). For horizontal position qualification the joint detail may, at the contractor's option, be as follows; single-bevel-groove, 45-deg groove angle, 1/4 in. root opening with backing(see Fig. 5.19b). Backing must be at least 3/8 in. by 3 in. (76.2 mm) if radiographic testing is used without removal of backing. It must be at least 3/8 in. by 2 in. (50.8 mm) for mechanical testing or for radiographic testing after the backing is removed. Minimum length of welding groove shall be 5 in. (127 mm).

5.20 Groove Weld Qualification Test for Butt Joints on Pipe or Square or Rectangular Tubing

The joint detail shall be in accordance with a qualified welding procedure specification for a single-welded pipe butt weld or shall be as follows: pipe diameter-wall thickness as required, single-V-groove, 60 deg included angle, 1/8 in. (3.2 mm) max root face and root opening without backing strip (see Fig. 5.20a), or single-V-groove, 60 deg included angle and suitable root opening with backing (see Fig. 5.20b).

5.21 Groove Weld Qualification Test for T-, K-, or Y-Connections on Pipe or Square or Rectangular Tubing

The joint detail shall be as follows: single-bevel, 37 1/2 deg included angle with bevel on pipe or tube at least 1/2 in. thick; the square edge pipe or tube shall be at least 3/16 in. (4.8 mm) thicker than the beveled pipe

D1.1-75 Limits of Qualified Positions

5.23 Position of Test Welds (See Table 5.23)

5.23.1 Groove Plate Test Welds

5.23.1.1. Qualification in the 1G (flat) position qualifies for flat position groove welding of plate, pipe and tubing, flat and horizontal position fillet welding of plate, and flat position fillet welding of pipe and tubing.

5.23.1.2. Qualification in the 2G (horizontal) position qualifies for flat and horizontal position groove and flat and horizontal position fillet welding of plate, pipe and tubing.

5.23.1.3. Qualification in the 3G (vertical) position qualifies for flat, horizontal, and vertical position groove and flat, horizontal, and vertical position fillet welding of plate.

5.23.1.4. Qualification in the 4G (overhead) position qualifies for flat and overhead position groove and flat, horizontal, and overhead position fillet welding of plate.

Table 5.23—Welder qualification—type and position limitations

Qualification test		Type of weld and position of welding qualified*			
		Plate		Pipe	
Weld	Plate or pipe positions**	Groove	Fillet	Groove	Fillet
Plate — groove	1G	F	F, H	F	F
	2G	F, H	F, H	F, H	F, H
	3G	F, H, V	F, H, V		
	4G	F, OH	F, H, OH		
	3G & 4G	All	All		
Plate — fillet	1F		F		F
	2F		F, H		F, H
	3F		F, H, V		
	4F		F, H, OH		
	3F & 4F		All		
Pipe — groove	1G	F	F, H	F	F
	2G	F, H	F, H	F, H	F, H
	5G	F, V, OH	F, V, OH	F, V, OH	F, V, OH
	6G	Note 1	Note 1	Note 1	Note 1
	2G&5G	Note 1	Note 1	Note 1	Note 1
	6GR	All	All	All	All

* Positions of Welding: F = flat, H = horizontal, V = vertical, OH = overhead.
** See Figs. 5.8.1.1, 5.8.1.2 and 5.8.1.3.

D1.1-75 Guided-Bend Test Procedure

5.27 Method of Testing Specimens

5.27.1 Root-, Face-, or Side-Bend Specimens. Each specimen shall be bent in a jig having the contour shown in Fig. 5.27.1 and otherwise substantially in accordance with that figure. Any convenient means may be used to move the male member with relation to the female member.

The specimen shall be placed on the female member of the jig with the weld at midspan. Face-bend specimens shall be placed with the face of the weld directed toward the gap. Root-bend and fillet-weld soundness specimens shall be placed with the root of the weld directed toward the gap. Side-bend specimens shall be placed with that side showing the greater discontinuity, if any, directed toward the gap.

The plunger shall force the specimen into the die until the specimen becomes U-shaped. The weld and heat-affected zones shall be centered and proportioned completely within the bent portion of the specimen after testing.

When using a wrap around jig, the specimen shall be firmly clamped on one end so that the specimen does not slide during the bending operation. The weld and heat-affected zones shall be completely within the bent portion of the specimen after testing. Test specimens shall be removed from the jig when the outer roll has been moved 180 deg. from the starting point.

D1.1-75 Acceptance Criteria - Bend Tests

5.12.1.2 Root-, Face-, and Side-Bend Tests. The convex surface of the specimen shall be examined for the appearance of cracks or other open discontinuities. Any specimen in which a crack or other open discontinuity exceeding 1/8 in. (3.2 mm) measured in any direction is present after the bending, shall be considered as having failed. Cracks occurring on the corners of the specimen during testing shall not be considered.

LINCOLN STABILIZER

INFORMATION ON

AWS QUALIFICATIONS

WELDING QUALIFICATION TESTS

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This information is based on the requirements contained in "Code For Welding in Building Construction" (AWS, D1.0-69) and "Specifications for Welded Highway and Railway Bridges" (AWS D2.0-69). It includes revisions published in the April 1970 issue of *The Welding Journal.*

There Are Three Different Tests as follows:

1. A test to qualify the Welding Procedure (and process) to be used for a specific welding project.
2. A Weldor Qualification test for manual electrode and semiautomatic operators.
3. A Welding Operator Qualification test for the men who operate fully automatic equipment.

The AWS Tests Are a Recognized Standard but they are not universal. Several industry and governmental agencies issue specifications that control certain types of work (See page 3). Therefore, qualification under AWS tests does not necessarily mean that weldors or procedures are qualified for all types of welding in all locations. Since the requirements of the governing code must be met, always be sure the test you select meets your needs.

Important Changes – New processes, more experience, and a better understanding of the objectives of qualification have led to important changes. Generally the 1969 requirements are more realistic than the previous requirements and are often less costly. For example:

1. The free bend test has been removed because it simply duplicates the information provided by the guided bend test.
2. Three plunger diameters have been established for the guided bend test, with the larger diameter used for higher strength steels in recognition of their lower ductility.
3. With proper test selection a weldor can qualify for unlimited plate thicknesses, for all types of fillet and groove joints, for any position, and for all 12 structural steels by welding only two test plates.
4. Allowance of radiographic inspection of test plates during weldor qualification eliminates the long time required for preparing machined test specimens. Therefore, weldors can often begin working a few hours after completing the tests.

There Are Four Sections in this bulletin as follows:

1. Pages 2 and 3 – A review of sample preparation and welding techniques to help prevent failures caused by factors other than operator error or process deficiency.
2. Pages 4 and 5 – Procedure (and process) Qualification requirements.
3. Pages 6 and 7 – Weldor Qualification (manual and semiautomatic Welding) requirements.
4. Page 8 – Welding Operator Qualification (fully automatic welding) requirements.

Figure 1 – DO NOT PREPARE SAMPLES LIKE THIS! Poor preparation undoubtedly contributed to these failures.

HOW TO PASS QUALIFICATION TESTS

While the AWS tests are designed to separate capable weldors from amateurs, many professional weldors have failed for reasons not related to their welding ability. The 1969 specifications minimize such possibilities by making the test a more positive demonstration of weld quality and welding skill. However, it is still possible to fail the test because of poor plate quality, improperly prepared samples or incorrect interpretation of the results. This is exasperating to the weldor and expensive to his employer. It is to everyone's advantage to see that the tests are run properly so the results are an accurate measure of welding ability.

The following is a review of some of the factors that can cause failures.

Select the Proper Test

Be certain you select the proper test details that will qualify for the type steel, plate thickness, joint and welding position to be used.

To Qualify	See Pages
A Welding Procedure	4-5
Manual Electrode Weldors	6-7
Semiautomatic Weldors	6-7
Automatic Welding Machine Operators	8

Check the Plate

Face and root bend tests are designed so both plate and weld stretch during the test. If the plate has strength substantially higher than the weld metal (and this is possible with steel purchased as mild steel) the plate will not stretch sufficiently, thereby forcing the weld metal to stretch beyond its yield and crack.

Welding Techniques

As indicated on page 6, one vertical and one overhead test plate can qualify a manual electrode or semiautomatic weldor for unlimited welding under the AWS codes. Since it permits using the weldor throughout the shop without restrictions, most testing is done in these two positions.

For unlimited manual electrode qualification, low hydrogen (usually Jetweld® LH-70 – E7018) is required. EXX10 or EXX11 electrodes are also frequently used, but do not qualify the weldor to weld with low hydrogen electrodes. Remember, low hydrogen electrodes require different techniques than EXX10 or EXX11. Train the weldors on these different techniques before testing, even if they are expert EXX10 weldors.

Critical to passing any of these tests is getting good penetration and sound weld metal in the root passes. To get good penetration, generally use the highest current you can handle within the recommended range for the electrode. Recommended ranges for Lincoln low hydrogen and L6010 and 6011 electrodes are in the following table. Consult electrode data for current ranges for other electrodes.

Electrode Size	Fleetweld® 5-5P-35	Jetweld® LH-70
1/8	70-100 amps	100-130 amps
5/32	100-120 amps	120-160 amps
3/16	160-180 amps	*210-240 amps

*3/16 Jetweld LH-70 not recommended for vertical and over head welding. Use 5/32 or smaller.

Many operators worry too much about appearance on the first beads. Appearance means nothing to the testing machine. But poor penetration and unsound weld metal cause most failures.

For manual electrode welding, make vertical welds with the vertical up technique. For gas metal arc or flux cored arc welding, vertical welds can be made either in the vertical up or vertical down direction. However, the weldor must use the same direction on the job as he used on the qualification test.

No preheat or postheat treatment is necessary or permissible to pass the test. It is, however, helpful to keep the plates hot during welding and allow them to cool slowly after completion. Interpass temperatures of 300-400°F are ideal and can usually be maintained by operating at a normal pace. Never quench the plates in cold water or accelerate the cooling rate in any other way.

Preparing the Specimen

Poor specimen preparation can cause sound weld metal to fail.

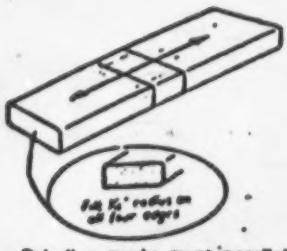
Specimen size, location and preparation is specified for each particular test (see pages 4 to 8).

The notch effect caused by even a slight nick across the sample may open up under the severe bending stress of the test causing failure. Therefore, always grind or machine lengthwise on the specimen as indicated in Figure 2. Always grind or machine both faces of the specimen until the entire bend area is even, leaving no indentations or irregular spots.

Remove all reinforcement. This is part of the test requirement and, more important to the weldor, failure to do so can cause failure of a good weld (see Figure 3). Be sure the edges are rounded to a smooth 1/16" radius. This can quickly be done with a file and is good insurance against failure caused by cracks starting at the sharp corner.

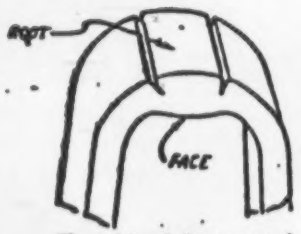
When grinding specimens, do not water quench them when they are hot. Quenching may create tiny surface cracks that become larger during the bend test.

The jig for testing weld specimens is shown in Figure 6. Note that three plunger diameters are required, with the larger diameter used for the higher strength steels in recognition of their lower ductility. Alternate test jigs are shown in Figures 5 and 6.



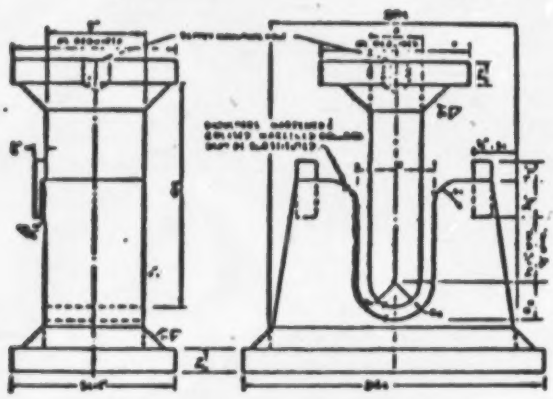
Grinding marks must parallel specimen edges. Otherwise they may have a notch effect which could cause failure.

Figure 2



If weld reinforcement is not removed, stretching is concentrated in two places and failure results.

Figure 3



NOTE: "t" refers to specimen thickness
"t" for AWS test is 3/8"
"t" for API Std. 1104 is tabulated wall thickness of pipe

Jig Dimensions	AWS TEST For Mild Steel			API Std. 1104 For All Pipe Grades
	50 ksi	55-70	90 ksi	
Radius of plunger R_A	1-1/2	2	2-1/2	1-3/4
Radius of die R_B	1-15/16	2-7/16	2-15/16	2-5/16

Figure 4 – Jig for guided bend test used to qualify operators for work done under AWS and API specifications.

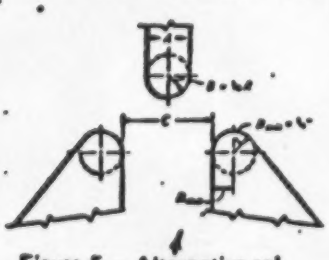


Figure 5 – Alternative roller equipped test jig for bottom ejection.

Figure 6 – Alternative wrap around test jig.

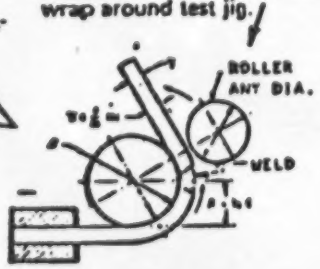


Figure 8

A	B	C	Yield Point-psi*	A	B
1-1/2	3/4	2-3/8	50,000 & Under	1-1/2	3/4
2	1	3-1/8	60,000 & Under	2	1
2-1/2	1-1/4	3-7/8	90,000 & Over	2-1/2	1-1/4

* Minimum Specified

Figure B.

Other Qualification Tests

The precautions of good penetration on the root pass, keeping the plates warm, and careful specimen preparation apply generally to all other qualification tests. A little care in these steps pays healthy dividends.

Sources of information for the common qualification tests are as follows.

Cross-Country Pipe Lines

a. For a review of pipe welding procedures, techniques and electrodes, request Lincoln bulletins M640 and M642 available free.

b. For the actual code, get "Standard for Welding Pipe lines and Related Facilities" ... API 1104 ... $.50 from the American Petroleum Institute, 1271 Avenue of the Americas, New York, N.Y. 10020.

Boilers, Pressure Vessels and Pipings

a. For a review of pipe welding procedures, techniques and electrodes, request Lincoln bulletin M640 available free.

b. For a readable version of the ASME code requirements get "Loss Prevention Data Sheet No. 15-4" for $.25 from Factory Mutual Public Relations & Publications, 1151 Boston-Providence Turnpike, Norwood, Massachusetts 02062.

c. For a detailed review of operator qualification tests for in-plant pipe welding, get "Pipefitter Welder's Review of Metallic Welding for Qualification under ASME Rules" for $.50 from National Certified Pipe Welding Bureau, Suite 1950, #2 Pennsylvania Plaza, New York, N.Y. 10001.

AWS Piping and Tubing

A code of growing national importance is AWS D10.9-69 "Standard For Qualification of Welding Procedures and Welders for Piping and Tubing." This standard provides three levels of Acceptance Requirements as follows:

AR-1 is for highest weld quality applications including nuclear energy, outer space, cryogenics, and certain chemical systems.

AR-2 is for high weld quality applications including pipelines and most pressure piping systems.

AR-3 is for pipe in less severe service such as domestic water and heating lines.

For a copy of this standard, send $6.00 to: The American Welding Society, 345 E. 47th St., New York, N.Y. 10017.

AWS Buildings and Bridges

a. Most state highway departments and other local government codes are based on the following AWS standards:

1. Code for Welding in Building Construction ..... D1.0-69 ..... $8.00
2. Specification for Welded Highway and Railway Bridges ..... D2.0-69 ..... $8.00

PROCEDURE QUALIFICATION

The welding procedures for work done in accordance with the AWS Building Code or Bridge Specifications must be "qualified" before fabrication can begin.

If the welding procedures conform to the provisions of Section 2 – Design, Section 3 – Workmanship, and Section 4 – Techniques, of the Building Code or Bridge Specifications, they are considered pre-qualified. In this case, no testing is required.

If the contractor wishes to deviate from these requirements, he must qualify the procedure. The qualification requirements are contained in Appendix A, Part 1 and are reviewed below. If the building commissioner or engineer accept evidence of previous qualification, this testing can be waived.

Prequalification of gas metal arc and flux-cored arc welding is applicable only to steels having a minimum specified yield strength of 60,000 psi or less and for weld throat thickness of 3 inches or less, otherwise a procedure qualification test must be made (103)

Procedure Qualification Requirements

For steels having a specified yield point of 50 ksi or less, qualification on any one also qualifies for all, or for any combination of the others (A101a1) having a minimum specified yield point equal to or less than that of the base metal used in the test. If the steel has a specified yield point in excess of 50 ksi, the procedure qualification test on this steel will only qualify this particular steel, grade, or type, and the same specified yield point. A reduction in yield point because of an increase in thickness of the particular steel is permitted. For example, a procedure qualified with 1" thick 100 ksi yield steel also qualifies for 3" thick 90,000 psi yield steel of the same ASTM specification (A101a2).

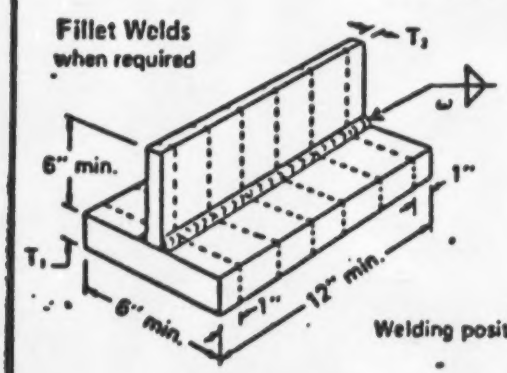
If a steel having a specified yield point in excess of 50 ksi is qualified to be welded to a steel having a specified yield point of 50 ksi or less, it is qualified to be welded to any other of the steels having a specified yield point of 50 ksi or less (A101a3).

The Procedure Qualification for groove welds joining material over 3/4"-thick states that the test plate shall be the same thickness as the material but need not exceed 1". Should the application in question involve 7/8"-thick material, the logical recommendation for procedure qualification would still call for 1"-thick plate, since the test is no more difficult than 7/8", and passing it would give "unlimited" qualification. Should 1" test plates not be available, however, the qualification test can be performed on any thickness greater than 1" and still give unlimited qualification.

A test joint for Partial Penetration Groove Welds (A107b) (A109(3)) shall be made for each type of joint and weld position, except that the depth of groove does not have to exceed 1". A macroetched cross section of the completed joint shall be made to show that the designated effective throat thickness is obtained and shall conform to the requirements of 307 for quality. Per A107(a) the test plates for groove welds for Gas Metal Arc, Flux Cored Arc, Electroslag and Electrogas welding shall be radiographically or ultrasonically tested.

When required by filler metal specifications applicable to weld metal being tested, test specimens may be aged at 200° to 220°F for 48± 2 hours (A107d).

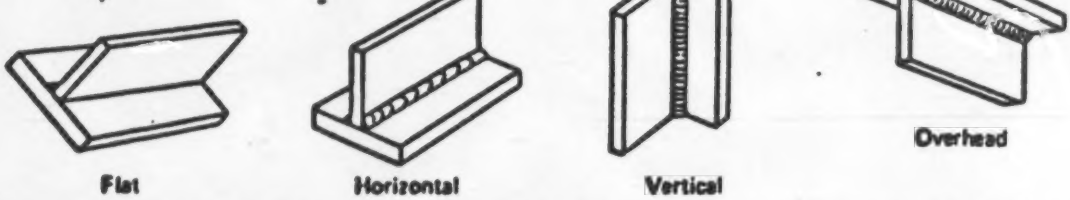
AWS Procedure Qualification Tests.



weld size ω	T_1	T_2
3/16	1/2	3/16
1/4	3/4	1/4
5/16	1-1/2	5/16
3/8	2-1/4	3/8
1/2	3	1/2
5/8	3	5/8
3/4	3	3/4
>3/4	3	1

Two test welds shall be made for each position to be used; one with the maximum size single pass fillet weld and one with the minimum size multiple pass fillet weld to be used.

Welding positions

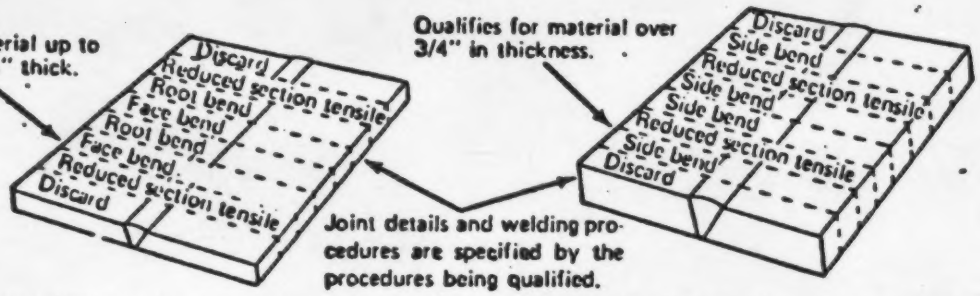


Flat Horizontal Vertical Overhead

Macroetch Test – The fillet weld shall show fusion to the root, but not necessarily beyond the root, and shall be free from cracks. Convexity and concavity shall not exceed the limits of 306(b). Both legs of weld shall be equal to within 1/8".

Groove Welds

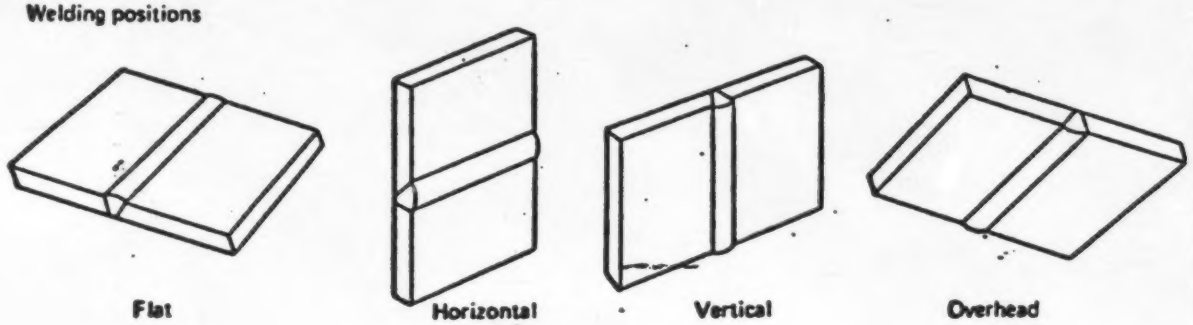
For material over 3/4" thick a test weld shall be made in material of the maximum thickness, but need not exceed 1".



Make 3/8" test plate for each position

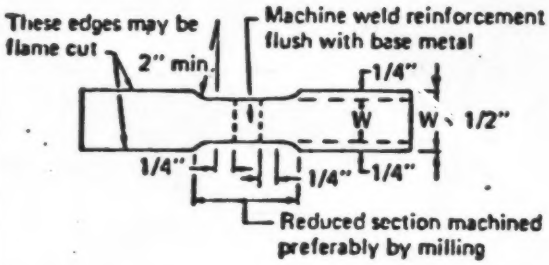
Make 3/4" or 1" test plate for each position

Welding positions



Flat | Horizontal | Vertical | Overhead

Reduced Section Tensile

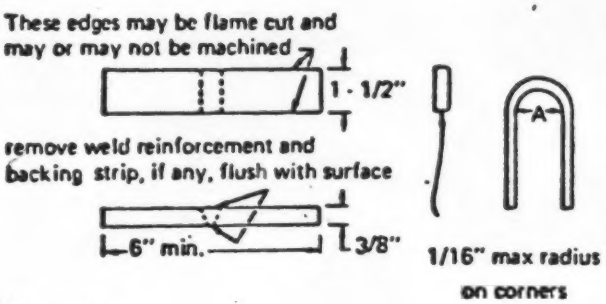


Tensile strength shall not be less than the minimum specified tensile strength of the base metal used. (may break in the weld)

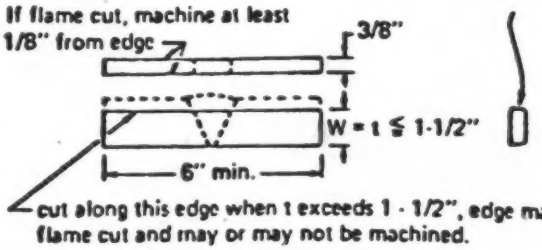
w = 1-1/2" if t ≦ 1"

w = 1" if t > 1"

Face & Root Bend


These edges may be flame cut and may or may not be machined
1 - 1/2"
remove weld reinforcement and backing strip, if any, flush with surface
6" min.
3/8"
A
1/16" max radius on corners

Side Bend


If flame cut, machine at least 1/8" from edge
3/8"
W = t ≦ 1-1/2"
6" min.
cut along this edge when t exceeds 1 - 1/2", edge may be flame cut and may or may not be machined.

YP	A
50 ksi & under	1-1/2"
55 to 90 ksi	2"
over 90 ksi	2-1/2"

NOTE: For plates over 1-1/2" thick, cut specimens into a minimum number of approximately equal strips not exceeding 1-1/2" in width.

Bend specimen passes if crack or other opening does not exceed 1/8" after bending through an angle of 180°. Crack at corners are not considered.

WELDOR QUALIFICATION

Manual electrode and semiautomatic weldors must be qualified in accordance with these requirements for work covered by the Building Code and Bridge Specifications. These requirements are also sometimes used by individual companies or specific agencies to prove the skill of welding operators.

Test Requirements

A weldor is qualified (A201a1) for any of the twelve weldable steels – A36, A53, A242, A375, A441, A500, A501, A514, A529, A570 D & E, A572, and A588 – if he qualifies for any one of them. For manual shielded metal arc, the proper electrode classification must be used.

With manual shielded metal-arc welding qualification with any of the following electrodes will qualify for any electrode having the same or lower group designation (A201a9), where XX represents the strength level of the electrode – 60, 70, 80, 90, 100, 110, and 120.

Group	AWS Electrode Classification
F4	EXX15 EXX16 EXX18
F3	EXX10 EXX11
F2	EXX12 EXX13 EXX14
F1	EXX20 EXX24 EXX27 EXX28

A weldor qualified with an approved combination of electrode and shielding medium is also qualified for any other approved combination of electrode and shielding medium for the same semiautomatic process as used in the qualification test (A201a4).

The types of joints and welding positions qualified with each test are indicated in the following table:

POSITION AND TYPE OF WELD QUALIFIED			
Test Position	Unlimited* & Limited** Thickness Test		Fillet Weld Tests***
Overhead OH	F & OH groove	F, H & OH fillet	F, H & OH fillet
Vertical V	F, H & V groove	F, H & V fillet	F, H & V fillet
Horizontal H	F & H groove	F & H fillet	F & H fillet
Flat F	F groove	F & H fillet	F fillet

* Qualifies for groove & fillet welds on material of unlimited thickness.

** Qualifies for groove welds in material not over 3/4" thick and fillet welds on material of unlimited thickness.

*** Qualifies for fillet welds on material of unlimited thickness.

The weldor making and passing a procedure qualification test is also qualified for that process and test position for plates of thicknesses equal to or less than the thickness of the test plate welded. In the case of 1 inch or over in thickness he will be qualified for all thicknesses.

A weldor could, thus, achieve unlimited qualification – would be qualified for making any type weld, in any welding position, on any thickness of plate, on any of the twelve weldable steels – by performing satisfactorily with just two weld test plates. Involved would be two groove welds having the prescribed bevel angle and root opening and joining 1"-thick material of any of the twelve weldable types, using an EXX15, 16, or 18 electrode. One weld would be made vertical and the other overhead. Radiographic inspection would eliminate any machining and bending.——

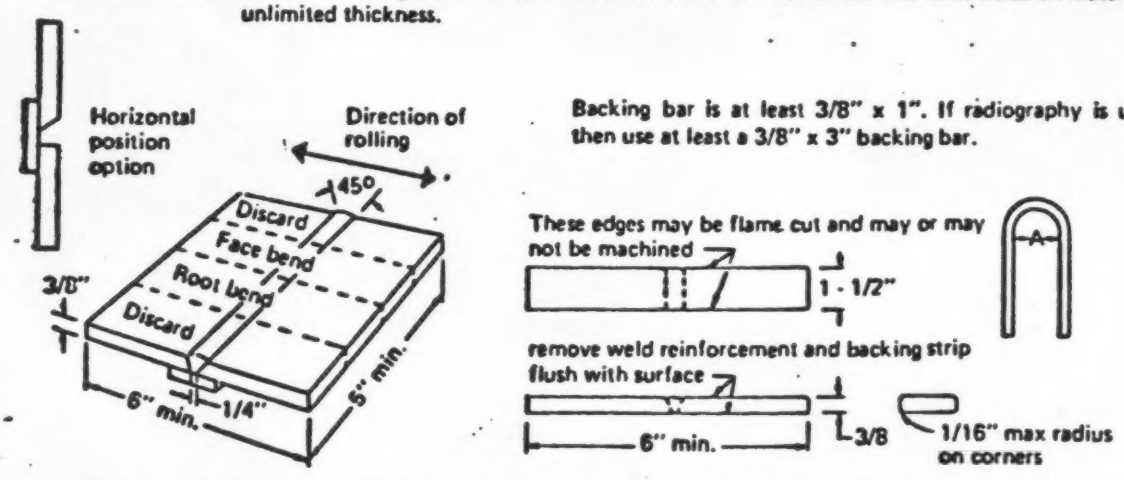
Welder qualification tests remain in effect indefinitely (A212) unless:

1. The welder does not work with the welding process for which he is qualified for a period exceeding three months. In this case a requalification test is required

(Continued on Page 7)

AWS Weldor Qualification Tests.

Limited thickness will qualify for groove welds in material not over 3/4" thickness and fillet welds on material of unlimited thickness.



Bend specimen passes if any crack or open defect does not exceed 1/8" after bending through an angle of 180°. Cracks at corners are not considered.

Radiographic inspection of test plate may be used instead of guided bend test. (A208)

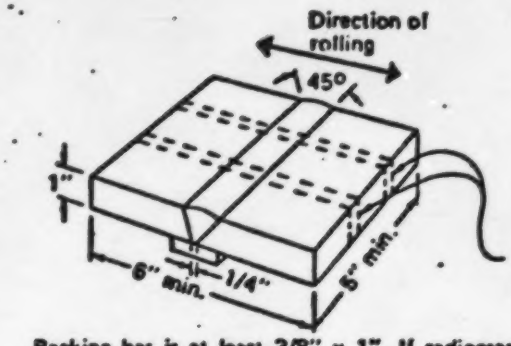
only on 3/8" thick plate.

2. There is specific reason to question his ability.

If a welder fails his test he may retest (A211) as follows:

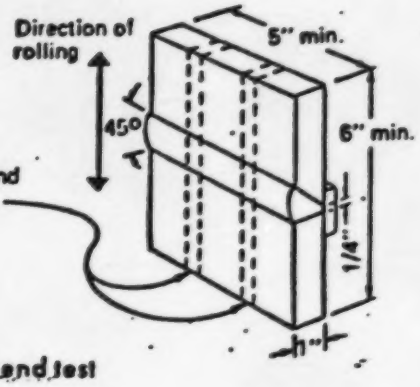
1. An immediate retest shall consist of two test welds of each type he failed and all test specimens must pass.
2. A retest can be made if the welder has had further training or practice. In this case a complete retest shall be made.

Unlimited thickness will qualify for groove or fillet welds in unlimited thickness



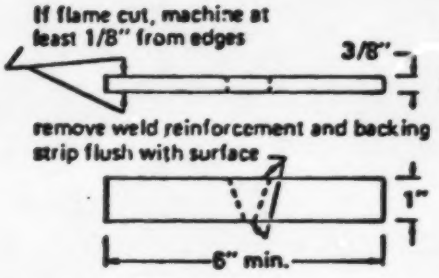
Backing bar is at least 3/8" x 1". If radiography is used then use a 3/8" x 3" backing bar.

Horizontal position option



2 side bend specimens

Guided side bend test



1/16" Max radius on corners

2 side bend specimens

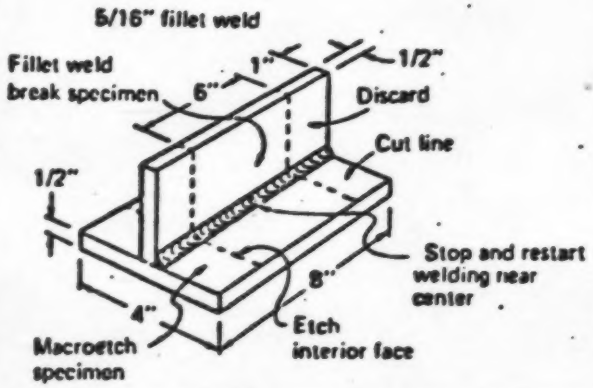
YP	A
50 ksi & under	1-1/2"
55 to 90 ksi	2"
over 90 ksi	2-1/2"

Bend specimen passes if any crack or other open defect does not exceed 1/8" after bending through an angle at 180°. Cracks at corners are not considered.

Radiographic inspection of text plate may be used instead of guided bend test. (A208)

Fillet Welds will qualify for unlimited thickness of material.

Option 1



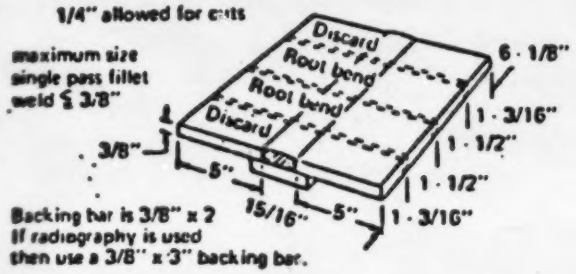
Visual inspection – a reasonably uniform appearance, free of overlap, cracks and excessive undercut, no surface porosity.

Next the 6" section is broken with the root of the weld in tension. The broken section of the weld shall show complete penetration into the root of the joint and fusion into the plate. No inclusion or porosity larger than 3/32". Sum of greatest dimension of all inclusions and porosity shall not exceed 3/8" in the 6" length. If plates are bent upon themselves without weld breaking, will pass.

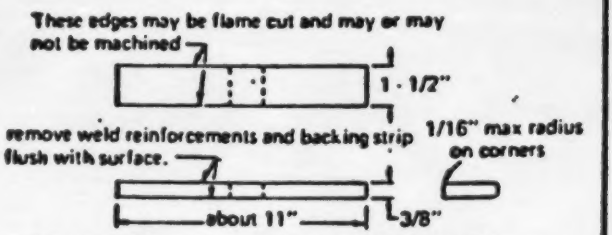
Macroetch test – shall show fusion to the root but not necessarily beyond root and no cracks – Convexity and concavity shall not exceed 5/16". Legs are equal to within 1/8".

(Continued on Page 8)

Fillet welds - Option 2



Radiographic inspection of test plate may be used instead of guided bend test. (A208)


These edges may be flame cut and may or may not be machined
1 · 1/2"
remove weld reinforcements and backing strip flush with surface.
1/16" max radius on corners
about 11"
3/8"

Flame cutting may be used for revomal of most of the backing provided the last 1/8" thickness is removed by machining or grinding.

Bend specimen passes if any crack or other opening does not exceed 1/8" after bending through an angle of 180°. Cracks at corners are not considered.

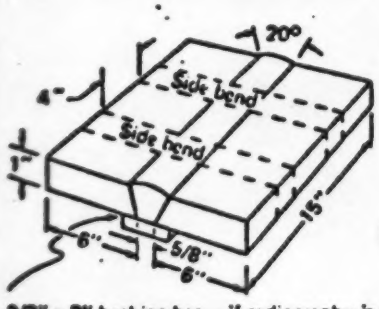
WELDING OPERATOR QUALIFICATION

Qualification of the man who operates a automatic welding equipment is covered by Appendix A, Part III. Here also, the operator is qualified to weld any of the 12 steels if he qualifies on any one of them (A301a1). An operator qualified for any approved combination of electrode and shielding medium is also approved for any other approved combination of electrode and shielding medium for the same process as used in the qualification test (A301a2). Qualification with multiple electrodes also covers single electrodes (A301a3).

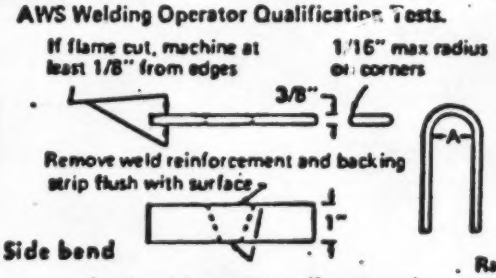
For Welding Operator Qualification, test plate thickness has been reduced from 1-1/2" to 1", substantially reducing the volume of weld metal and the time required for completing a test plate.

The welding operator making and passing a procedure qualification test is also qualified for that process and test position for plates of thicknesses equal to or less than the thickness of the test plate welded. In the case of 1" or over in thickness he will be qualified for all thicknesses.

AWS Welding Operator Qualification Tests.



3/8" x 2" backing bar – if radiography is used, use at least a 3/8" x 3" backing bar


If flame cut, machine at least 1/8" from edges
1/16" max radius on corners
3/8"
Remove weld reinforcement and backing strip flush with surface
1"
A
Side bend

YP	A
50 ksi & under	1-1/2"
55 to 90 ksi	2"
over 90 ksi	2-1/2"

Bend specimen passes if any crack or other opening does not exceed 1/8" after bending through an angle of 180°. Cracks at corners are not considered.

Radiographic inspection of test plate may be used instead of guided bend test. (A305a) will qualify for plate of unlimited thickness with groove and fillet welds.

THE RADIOGRAPHIC EXAMINATION OF WELDS

Radiographic examination of test plates for weldor and welding operator qualification may be used in place of the guided bend test. Radiographic examination, in addition to being more fair (in that it gives a more positive appraisal of the weld), could easily reduce the cost of qualification tests to but 10% of what they were previously by eliminating the machining of test specimens. Furthermore, this option will permit a weldor to be tested in the morning and put to work in the afternoon, avoiding the time delays that have frustrated employers and employees alike.

The AWS Building Code and Bridge Specifications for radiographic weld inspection will be applicable to the examination of qualification welds by radiography.

STUDENT RECORDS

WELDING III - 72201 - COMMUNITY COLLEGE OF ALLEGHENY COUNTY - CENTER-NORTH

STUDENT NAME_____ SOCIAL SECURITY NO._____

This is to certify that the above-named student has demonstrated proficiency in the following tasks:

Competency Task	Completed	Instructor
1. Set up - tack vee groove w/ backing (ASME), E-7018		
2. Vee groove w/ backing 1G position (ASME), E-7018		
3. Machine oxygen cut test plates		
4. Vee groove w/ backing 3G position (ASME), E-7018		
5. Set up - tack vee groove w/ backing 1G position (AWS) E-7018		
6. Vee groove w/ backing (AWS), E-7018		
7. Vee groove w/ backing 3G position (AWS) E-7018		
8. Guided Bend Test - prepare and bend		
9. Set up - tack vee groove w/ backing (AWS) 2G, E-7018		
10. Vee groove w/ backing or single bevel w/ backing (AWS) 2G position, E-7018		
11. Set up oxy-acetylene equipment		
12. Puddling on mild steel		
13. Running beads w/ filler rod		
14. Butt weld 1/8" m.s.		
15. Gas weld corner joints		
16. Gas weld lap joints		

WELDING III 72-201

STUDENT RECORD CLASS ROSTER

DATE

1.	Set up - tack vee groove w/ backing (ASME) E-7018
2.	Vee groove w/ backing, 1G, (ASME) E-7018
3.	Machine oxygen cut test plates
4.	Vee groove w/ backing 3G (ASME) E-7018
5.	Set up - tack vee groove w/ backing 1G (AWS) E-7018
6.	Vee groove w/ backing (AWS) E-7018
7.	Vee groove w/ backing 3G (AWS) E-7018
8.	Guided Bend Test - prepare and bend
9.	Set up - tack vee groove w/ backing (AWS) 2G E-7018
10.	Vee groove w/ backing or single bevel w/ backing (AWS) 2G E-7018
11.	Set up oxy-acetylene equipment
12.	Puddling on mild steel
13.	Running beads w/ filler rod
14.	Butt weld 1/8" m.s.
15.	Gas weld corner joints
16.	Gas weld lap joints
	FINAL EXAM

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